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Econometric Modeling of the Investment Capacity of Industrial Enterprises in the Conditions of the Digital Economy

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***Annotation*:** As a result of the scientific research, the article proved that the most important factor positively influencing the change of investments in fixed capital is the growth of transportation, storage, information and communication services and foreign trade turnover. Also, it was concluded based on the Engel Grinder correlation cointegration test that the increase of investments causes the long-term growth of the production of industrial products through the SEM model.

Keywords: *digital economy, green investment, digital investment, growth of industrial production, growth of investment in fixed capital, number of small businesses and entrepreneurial entities, growth of transportation, storage, information and communication, foreign trade turnover.*

1. Introduction

Application of investments into the company is the key feature of effective operation for the long term in the context of digitalization of social life and national economy. Wherever tight correlation between investments and company exists, there high probability of provision of their cointegration of connection.As a result of the scientific researches, it was proved that the development of China's industrial enterprises until 2050 is directly dependent on the investment policy. The authors modeled the investment potential based on the Input-Output model using the industrial and investment indicators of China from 2000 to 2014 .The result of the model is that expenses spent on R&D (Research and Development) and innovative research, has the greatest impact on the investment potential (Wei Zhang et al.).Another unique aspect of this study, the term "digital investment " is also analyzed in the article. The considered industry was divided into 18 groups, R&D and digital investment effectiveness were assessed for each group. The groups with the highest the value of these two factors, has been selected to have long-term viability.There were determined the need to increase the investment potential of industrial enterprises with " green investment " based on hypothesis tests with context of digital economy (Shuangyan Li et al.) . Using the Benchmark model in their research, the scientists econometrically modeled the influence of factors such as the level of the digital economy in the country, population, number of industrial enterprises, foreign trade balance, the development of industry in the country, and the level of urbanization in the development of green investment.

The considered hypotheses:

H_1 : the growth of fixed capital has a cointegrating relationship with the growth of industrial production.

H_2 : there is a strong relationship between fixed capital and the number of small businesses and entrepreneurs.

H_3 : the increase in transportation, storage, communication and information causes the growth of fixed capital

H_4 : an increase in foreign trade turnover ensures the attractiveness of fixed capital.

These four hypotheses represent the main factors affecting the investment potential of industrial enterprises in the digital economy. We determine this by the following formula.

$$lnAKI = \beta_0 + \beta_1 lnSANOAT + \beta_2 lnKTS + \beta_3 lnTSAA + \beta_4 lnTS \quad (1)$$

In this formula:

AKI is the growth of fixed capital investment

INDUSTRY- growth of industrial production

KTS- the number of small businesses and entrepreneurial entities

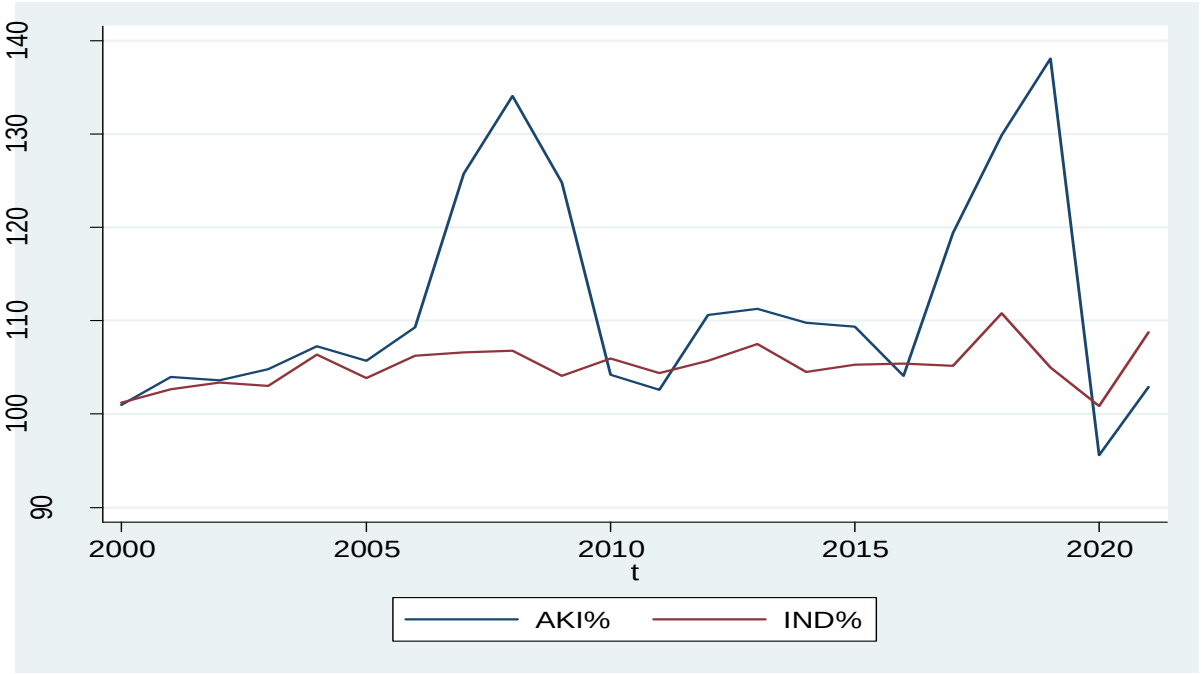
TSAA- transport, storage, information and communication growth

TS - foreign trade turnover, in million US dollars

Table 1 Descriptive statistics of K indicators

Variable	Obs	Mean	Std. Dev.	Min	Max
AKI	22	111.741	11,653	95.6	138.1
IND	22	105.169	2.288	100.9	110.8
KTS	22	236497.59	111432.65	118749	528929
TSAA	22	108.805	4.703	99.93	117,792
TS	22	21476.671	11454.316	5700.4	42170.5

Our preliminary conclusion that there is a strong volatility in the change of the fixed capital is evaluated by the fact that the situation of sharp increases and decreases was observed during the years selected for analysis. The average change of fixed capital from 2000 to 2021 was 111.74%, the highest increase was 138.1% in 2019, and the lowest change was 95.6% compared to the previous year. This happened after the peak growth in 2020.



1 . Dynamics of capital investments and production of industrial products in the Republic of Uzbekistan in 2000-2021

The production has a constancy in industrial companies, and according to our preliminary conclusions, the time series has stationarity. During the years 2000-2021, the average production of industrial products in the republic was 105%, in twenty years, the volatility moved around the average. We can see this situation from the picture above. At this point, we would like to emphasize that it is too early for us to conclude whether these indicators have a cointegrating relationship, because in our opinion, cointegration should exist in the long run.Since the factor signs and the resulting sign are time series data over the cross-section of years, we begin the analysis by

determining their stationarity. Checking of stationarity in econometrics mainly in three different ways has been cited in several foreign scientific works. The unit root test, Dickey Fuller test are considered reliable. If all the signs are non-stationary at the same time, we check their result by the Johansen test of cointegration relationship and present the mutual analysis based on Angel Granger. For the model, we choose VAR and VEC time cointegrated multifactor model types.In literature, non-stationary periodic series are also referred to as "integrated process". The degree of integration of the series is determined by how many times it needs to be differentiated to make it stationary. Thus, the stationary series is "zero-order integrable" and is abbreviated as I(0). When a series becomes stationary after being differentiated once, it is said to be first-order integrable and denoted I(1). In general, periodicrow dis stationary after differentiating times dis called integrated of degree and is defined as I(d).

$y_t = \beta_0 + \beta_1 x_t$ Nonstationary periodic series integrated at the same level are called cointegrated periodic series. If, x_t and The variables y_t are cointegrated to degree d, and$y_t = \beta_0 + \beta_1 x_t$ linear equality if there is a vector ( ) providing degree integration (db) (where b>0) , then $\beta_0, \beta_1 x_t$ andy_t(db) is called cointegrated in degree and(x_t, y_t) is written as ~CI (db). Here, $\beta_0, \beta_1$the vector ( ) is called the cointegration vector. If this definition is applied to the two-variable case, then the case of the k-variable cointegration system can also be derived.Since the cointegration test requires the integration level of the variables, the integration level for each variable is determined before the cointegration tests. For this, the Dickey-Fuller(DF) test is used. This test was developed by Dickey and Fuller and is based on 4 equations and is called the Unit Root Test:

$$\Delta Lny_t = \delta Lny_{t-1} + u_t \quad (5)$$

or

$$Lny_t = (1 + \delta) Lny_{t-1} + u_t \quad (6)$$

In the next step, the cointegration relationship between these variables is checked using tests such as DurbinWatson Cointegration, Johansen Cointegration.the Granger Causality test is usedto determine the direction of the relationship between the variables . In this test tool, the factor character stimulates the resultant character or vice versa.Here, most authors mainly used the Johansen cointegration test, which is more efficient and reliable in multivariable situations. After the cointegration relationship is estimated, the VAR model is used to examine the short- and long-run dynamics .

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. dfuller d.AKI

Dickey-Fuller test for unit root                   Number of obs   =        20

                                 ---------- Interpolated Dickey-Fuller ----------
                    Test         1% Critical       5% Critical      10% Critical
                 Statistic           Value             Value            Value
------------------------------------------------------------------------------
 Z(t)             -4.434            -3.750            -3.000           -2.630
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0003

. dfuller d2.KTS

Dickey-Fuller test for unit root                   Number of obs   =        19

                                 ---------- Interpolated Dickey-Fuller ----------
                    Test         1% Critical       5% Critical      10% Critical
                 Statistic           Value             Value            Value
------------------------------------------------------------------------------
 Z(t)             -3.583            -3.750            -3.000           -2.630
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0061
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. dfuller SANOAT

Dickey-Fuller test for unit root                   Number of obs   =        21

                                 ------------ Interpolated Dickey-Fuller ------------
                 Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value            Value
------------------------------------------------------------------------------
 Z(t)           -4.535            -3.750            -3.000           -2.630
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0002
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. dfuller TSAA

Dickey-Fuller test for unit root                   Number of obs   =        21

                                 ------------ Interpolated Dickey-Fuller ------------
                 Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value            Value
------------------------------------------------------------------------------
 Z(t)           -3.770            -3.750            -3.000           -2.630
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0032
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. dfuller d.TS

Dickey-Fuller test for unit root                   Number of obs   =        20

                                 ------------ Interpolated Dickey-Fuller ------------
                 Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value            Value
------------------------------------------------------------------------------
 Z(t)           -4.448            -3.750            -3.000           -2.630
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0002
```

Fixed capital investment is non-stationary in zero-order time series, Mas Kinnon approximate p-value is 0.0504, theoretically required to be less than 0.05, so it was necessary to differentiate the series and check the value of repeated unit root test. After first-order integration, fixed capital investment became a stationary series. The probability value is 0.0003. It is enough to make a decision, as well as the value of test statistics -4.434 and Interpolated Dickey-Fuller 1%, 5%, 10% Critical Value -3.750, -3.000, -2.630 respectively.Industrial production is a stationary time series with a Mas Kinnon approximate p-value of 0.0002 and a test statistic of -4.535, which is smaller than other critical values.The fact that the strong non-stationary time series is the number of small businesses and entrepreneurs is explained by the fact that this time series becomes a stationary time series as a result of double differentiation. The second-order integrated series unit root test showed a probability of less than 0.05.Such without simple regression model cannot be used, the outcome factor is non-stationary, the factor signs are both stationary and non-stationary. The most optimal model is the VAR model, and it is becoming clear that in the long term, it is necessary to examine the cointegration relationship of investments in fixed capital and production of industrial products.

Vector autoregression

Sample: 2002 - 2021		Number of obs	= 20
Log likelihood	= 98.37667	AIC	= -8.237667
FPE	= 9.97e-07	HQIC	= -8.082165
Det(Sigma_ml)	= 1.83e-07	SBIC	= -7.441081

Equation	Parms	RMSE	R-sq	chi2	P>chi2
lnAKI	8	.06655	0.7281	53.56849	0.0000
lnSANOAT	8	.012122	0.7713	67.43207	0.0000

The VAR model is a statistical significance value

The model is statistically significant, with an Akaike criterion value of -8.23. The probability level is less than 0.05.

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	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lnAKI						
lnAKI						
L1.	.8238101	.2307922	3.57	0.000	.3714657	1.276154
L2.	-.6570188	.1867965	-3.52	0.000	-1.023133	-.2909045
lnSANOAT						
L1.	.6892674	1.051387	0.66	0.512	-1.371413	2.749948
L2.	-2.136164	1.112711	-1.92	0.055	-4.317037	.0447092
lnKTS	.0253278	.0849785	0.30	0.766	-.1412271	.1918827
lnTSAA	1.262476	.3527532	3.58	0.000	.5710925	1.95386
lnTS	.0759776	.0649475	1.17	0.242	-.0513172	.2032725
_cons	3.683609	8.435506	0.44	0.662	-12.84968	20.2169
lnSANOAT						
lnAKI						
L1.	.142308	.0420394	3.39	0.001	.0599124	.2247036
L2.	-.1387739	.0340254	-4.08	0.000	-.2054625	-.0720853
lnSANOAT						
L1.	-.9259295	.1915126	-4.83	0.000	-1.301287	-.5505716
L2.	-.7348508	.2026829	-3.63	0.000	-1.132102	-.3375996
lnKTS	-.0268483	.015479	-1.73	0.083	-.0571867	.00349
lnTSAA	.2176687	.0642548	3.39	0.001	.0917315	.3436058
lnTS	.0568329	.0118304	4.80	0.000	.0336459	.08002
_cons	11.12151	1.536548	7.24	0.000	8.109935	14.13309

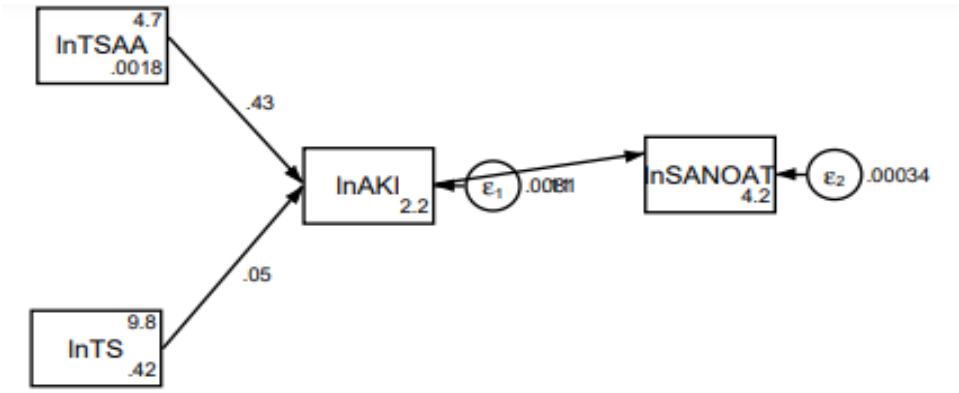
Value of model coefficients

In this model, investments in industrial products and fixed capital are selected as the result indicators, and the number of small businesses and entrepreneurs, transportation, storage and information, communication factors are selected as indicators. Based on the values of coefficients and the level of probability, the number of small businesses and entrepreneurs is not statistically and economically significant.

Equation	Excluded	chi2	df	Prob > chi2
lnAKI	lnSANOAT	7.1748	2	0.028
lnAKI	ALL	7.1748	2	0.028
lnSANOAT	lnAKI	20.213	2	0.000
lnSANOAT	ALL	20.213	2	0.000

Engel Granger cointegration test result

The Engel Granger test found that the value of fixed capital investment has a greater effect on the industry. So, in this case, from the SEM model we use.



SEMmodel

As a result of scientific research, the most important factor positively influencing the change of investments in fixed capital is the growth of transportation, storage, information and communication services and foreign trade turnover. The fact that such indicators have a strong influence on investments was also carried out in accordance with the object of scientific research. Because transportation, storage, information and communication services represent the digital economy.A one percent increase in transportation, storage, information and communication services leads to a 0.43 percent increase in investment. A 1% increase in foreign trade leads to a 0.05% increase in investment.On the other hand , through the SEM model, it was determined that the increase in investment leads to a long-term increase in the production of industrial products.

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